Contract Number: W9132T-04-C-0018

Offeror: IdaTech, LLC

IdaTech 2003 PEM Demonstration Program in Omaha, Nebraska with Offutt AFB/Omaha Public Power District

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

Locations

1. Offutt Air Force Base, Elkhorn 200, Elkhorn, Nebraska
2. Offutt Air Force Base, Building 304, Omaha, Nebraska

October 28, 2004

Executive Summary

The offeror and manufacturer, IdaTech, will demonstrate two systems at the Offutt AFB in Omaha, NE with Subcontractor Omaha Public Power District (OPPD). One Offutt AFB system will use propane fuel, operate off-grid and be located outdoor. The other Offutt system will use natural gas fuel, operate off-grid and will be located indoors. Each system will be rated at 4.6 kW AC output and will not operate in CHP mode.

System	Location	Fuel	Mode	CHP	Location
#1	Elkhorn, NE	propane	off-grid	no	outdoor
#2	Omaha, NE	natural gas	off-grid	no	indoor

The energy generated from the demonstration is estimate to be approximately 31,503 kWh of electricity assuming that the fuel cell systems operate at an average output of 2.0 kW for 90% of a full year per system.

The point of contact at Offutt AFB will be, Mark Tungland, Energy Manager, Phone 402-294-5379, 55th CES/CECEE, Offutt AFB, NE. 68113, mark.tungland@offutt.af.mil.

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1.0 Descriptive Title

IdaTech 2003 PEM Demonstration Program in Omaha, Nebraska with Offutt AFB/Omaha Public Power District.

2.0 Name, Address and Related Company Information

Name: IdaTech, LLC (IdaTech)
Address: 63160 Britta St., Bend, OR 97701
Phone: 541-383-3390
Fax: 541-383-3439
DUNS Number: 95-789-2193 CAGE Code: 1M0T9
TIN: 93-1202376

Located in Bend, Oregon, IdaTech is a world-class energy technology company focused on the development and commercialization of fuel processor technology and integrated Proton Exchange Membrane (PEM) fuel cell solutions. Founded in 1996, IdaTech has developed some of the most compact and efficient fuel processors and fuel cell systems operating on a variety of common fuels, including natural gas, propane, methanol, and low-sulfur liquid hydrocarbons. Additionally, IdaTech continues integrating its fuel processor technology with the best available fuel cell power modules to develop power systems from 1 to 50 kilowatts for a wide range of portable and stationary applications. These systems are being demonstrated, evaluated, and field-tested in various applications with business partners in North America, Europe, and Japan. IdaTech currently employs approximately 65 people.

3.0 Production Capability of the Manufacturer

As described in Section 2.0 above, IdaTech is a world-class developer and manufacturer of fuel cell systems and fuel cell components including fuel processors and fuel cell stacks and is fully capable of supplying the required components for the proposed systems. IdaTech manufactured approximately 25 fully integrated fuel cell systems in 2003. IdaTech's philosophy towards manufacturing volume and demonstrations is orderly development. In practice, this means IdaTech manufactures enough systems to statistically validate technology advances and then places a limited number of those systems in the field to further validate the technology. This discipline ensures that IdaTech engineers are able to advance development goals rather than continuously support prototype demonstrations. IdaTech has selected this CERL opportunity due to its outstanding opportunity to display high performance in a well-publicized forum to a key target market.

In support of the field demonstration IdaTech will provide support through 40 hours of on-site field installation services and 40 hours of training services that will be provided with the delivery of the fuel cell system. Site preparation including an appropriate pad, plumbing potable water, electrical interconnection with load including transfer switch if needed and any required security and landscaping are the responsibility of the host site and partner utility. Site remediation is also outside the scope of the fuel cell manufacture and will be provided by the host site and utility partner.

IdaTech contact information is detailed in Section 2.0 above.

4.0 Principal Investigator(s)

Bill A. Pledger
Senior Vice President & Chief Engineer
IdaTech, LLC
Phone: 541-322-1025
Fax: 541-383-3439
E-Mail: bpledger@idatech.com

Education
1982: B.S. in Chemical Engineering, Oregon State University, Corvallis, Oregon
Professional Accreditation
1977: Professional Engineer in State of Oregon
Professional Highlights
1996-Present: Senior Vice President, Chief Engineer, IdaTech, LLC. Directs design, development and testing of fuel cell systems and major subsystems. Areas of expertise include metallic membranes, membrane reactors, membrane module design and construction, chemical process equipment and process modeling.
1994-1996: Chief Engineer, Micromonitors, Inc., Bend, Oregon. Responsible for field-testing and evaluation of microelectronic, electrical transformer fault gas analyzers.
1992-1994: Senior Engineer, Bend Research, Inc., Bend, Oregon. Responsible for design and construction of membrane-based systems and pilot plants. Areas of expertise include process modeling and electronic system design and construction.
1985-1992: Research Engineer, Bend Research.

Bill Pledger can be reached through the contact information listed in section 2.0 above.

5.0 Authorized Negotiator(s)

Name: Hal Koyama
Title: Vice President of sales and Marketing
Company: IdaTech, LLC
Phone: 541-322-1000
Fax: 541-383-3439
Email: hkoyama@idatech.com

6.0 Past Relevant Performance Information

IdaTech has been successful developing systems and solutions that specifically address a customer's or development partner's business problem. The following is a list of recent examples:

1. Scaleable power solution for The U.S. Army Communications – Electronics Command (CECOM). CECOM contracted with IdaTech to develop a 2 kW fuel cell system to power an array of communications and other electronic equipment on a High Mobility Multipurpose Wheeled Vehicle (HMMWV - pronounced Hum-Vee).
   Customer: US Army – CECOM

2. Hybrid power solution combining fuel cells with photovoltaics – IdaTech and Electricite de France (EDF) jointly integrated a fuel cell system with photovoltaic (PV) technology in a hybrid power system for remote locations.
   Customer: Electricite de France

3. Propane fueled fuel cell system for telecommunication applications – Working under two funding grants from the Propane Education and Research Council (PERC), IdaTech proved its' capabilities related to fuel processing and system integration for propane fueled fuel cell systems.
   Customer: Propane Education and Research Council (PERC)

4. Natural gas fuel cell system for German Utility – Over a three month period, IdaTech worked closely with a German Utility for the design and development of a fully integrated natural gas fuel cell system for a multi-family building. IdaTech leveraged its modular design philosophy and took existing building blocks (fuel cell module, fuel processor module, power electronics, etc.) to have a system ready for factory acceptance testing within 60 days from time of contract.
   Customer: German Utility

7.0 Host Facility Information

Offutt AFB is home to the Fifty-Fifth Wing of the US Air Force. The 55th Wing is the largest wing in Air Combat Command and the second largest in the Air Force. The Fightin' Fifty-Fifth has made significant contributions to the defense of our nation for more than 50 years. Having won honor and distinction for its combat record during World War II with two Distinguished Unit Citations, the wing has since compiled an admirable record of achievements. The history of the Fightin' Fifty-Fifth began in January 1941, when the 55th Pursuit Group was activated at Hamilton Field, California. Assigned the mission of escorting 8th Air Force bombers on daylight bombing raids over Europe, the group completed its combat tour of duty with a distinguished record in seven campaigns. The 55th SRW moved to Offutt AFB, Nebraska, in August 1966. That same year the 55th's 38th Strategic Reconnaissance Squadron assumed responsibility for SAC's airborne command and control system. The 55th Strategic Reconnaissance Wing became the 55th Wing on September 1, 1991, to reflect the wing's performance of a diversity of missions. When SAC disestablished and Air Combat Command (ACC) established, the wing transferred to ACC.

Offutt AFB will be acting as a Project Partner and Site Owner to IdaTech. As the Site Owner, Offutt AFB will be responsible for identifying the site and gaining necessary approvals to site the fuel cell systems with the command of the base. Additionally, Offutt AFB personnel will be involved in operational training and participate in the installation and maintenance activities as required. Mark Tungland is authorized to act on behalf of Offutt AFB during the project development, site selection process, contract negotiations, and installation/operation of the fuel cell system. Mr. Tungland is the Energy Manager for

Offutt. Contact Information is: phone 402-294-5379, 55th CES/CECEE, Offutt AFB, NE. 68113, mark.tungland@offutt.af.mil.

OPPD will be acting as a Project Partner and Sub-Contractor to IdaTech and is also the local electric utility. Propane will be supplied to the project by Ferrell Gas (402-895-2344). As the Sub-Contractor, OPPD will be responsible for the on-site project management, installation, start-up, and the on-going operational maintenance, support, and troubleshooting. Terry Johnson is authorized to act on behalf of OPPD during the proposal development, site selection process, contract negotiations, and installation/operation of the fuel cell system. Mr. Johnson is a Project Manager for OPPD. Contact Information: 402.636.3321 or via email at tdjohnson@oppd.com.

Figure 1. Front Gate at Offutt AFB

Offutt Air Force Base (Offutt AFB) and the Omaha Public Power District (OPPD) have established a strong relationship over the past 55 years. In addition to delivering WAPA and OPPD energy to the base, OPPD has worked closely with Offutt's 55th Civil Engineering Squadron to improve energy efficiency and technology through performance contracting. This has come in the form of nine demand side management projects (Task Orders) valued at nearly $18 million. These projects will enable Offutt to meet the presidential directive (Executive Order 12902) which requires a 30% energy reduction by the year 2005.

8.0 Fuel Cell Site Information

One fuel cell system will be placed at each of the two Offutt AFB sites described below. Each fuel cell system will have a continuous power capacity of 4.6 kW AC net out. The

model “etaGen 5” PEM fuel cell system will be manufactured by the offeror, IdaTech. There are no special permitting issues required at either of the two Offutt AFB sites.

Building 304 is located on the NE corner of the historic Martin Bomber Plant at Offutt AFB. This building contains a major portion of the electrical distribution switchgear that serves approximately 35% of the Base electrical loads. Building 304 also houses the mechanical equipment that serves the HVAC needs of the Plant and numerous surrounding support buildings. Building 304 is an ideal location for the fuel cell because of the numerous electrical distribution systems in-place and the 24/7 operating schedules of the electrical distribution, HVAC, and lighting systems.

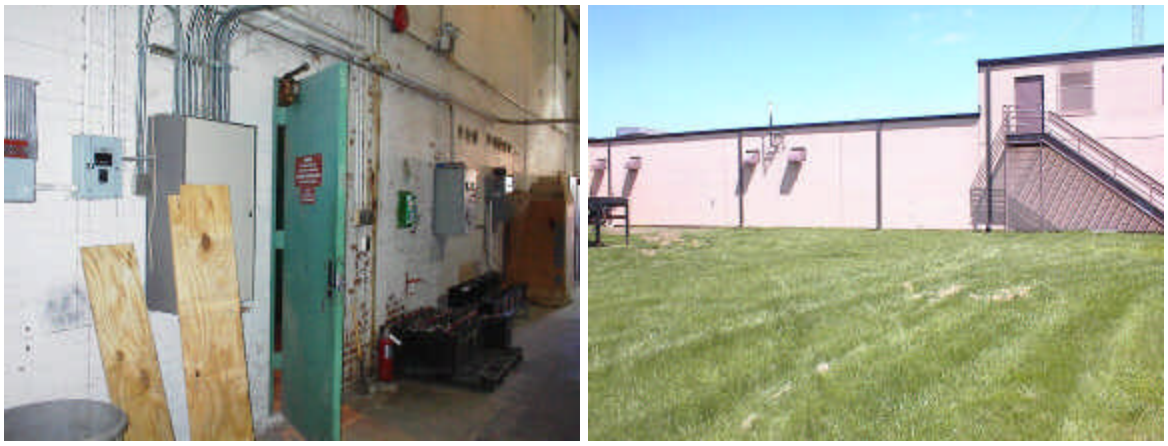

Figure 3. Planned location of the fuel cell system inside Offutt AFB Building 304 (left) and planned location of the fuel cell system outside Offutt AFB Elkhorn Building 200 (right).

Building 200 is Offutt AFB’s remote UHF/VHF communications and relay facility located approximately 30 miles NW of Offutt AFB near Elkhorn, NE. This communication facility serves numerous military, space, and civilian communication needs in the region. The facility has a peak electrical demand of less than 150 KW and has minimum operation personnel assign to it.

The system that will be sites at Offutt Air Force Base, Building 304, will be a natural gas etaGen 5 fuel cell system that will be running inside, off grid and will be continuous powering a 2 kW load that includes a UPS system battery charger and security lighting.

The etaGen 5 PEM fuel cell system contains five process flow connections. They are: a 6” galvanized duct for the system exhaust, a ½” NPTM fuel inlet, and a 3/8” Tube “Push-Connect” for the De-ionized water inlet. An external multi-stage water treatment system will be supplied with this system. There are also some electrical connections for power and remote monitoring.

The ancillary equipment that will be included in this system will be: a DC/AC inverter designed to take the DC voltage from the fuel cell and change it to 120/240V AC output, absorbed glass mat lead acid Batteries in a 120V/26amp hour bank, fuel clean up module for sulfur removal, a water purification system that has been designed with knowledge of local water quality, and a radiator system for heat dissipation.

The planned operating procedure for the system is to provide power for a battery charger and some security lighting that should amount to 1.5 to 2kW$_e$. This will serve as the system's base load. The fuel consumption at base load conditions should be approximately 13slpm of natural gas (@25°C) and 28ml/min of water. The system is capable of producing a maximum output of 4.6kW$_e$, and will ramp up as necessary to match an increase in the load. The fuel consumption at maximum output is approximately 28slm of natural gas (@25°C) and 62ml/min of water. The system is designed for unmanned operation unless the system calls for outside intervention. The run data from the system will be retrieved by IdaTech in a process described below in Section 11.0.

Combustion exhaust and other gases are exhausted from the fuel cell system through an exhaust duct located at the back of the system enclosure. These gases must be vented to the outdoors through an exhaust ducting system. The exhaust ducting system includes a fan that must be installed in the exhaust duct.

The system that will be sited at Offutt Air Force Base at Elkhorn Building 200 will be a propane etaGen 5 fuel cell system that will be running outside, off grid and will continuously power 2 kW AC of security lighting. .

The etaGen 5 PEM fuel cell system contains five process flow connections. They are: a 6" galvanized duct for the system exhaust, a ½" NPTM fuel inlet, and a 3/8" Tube "Push-Connect" for the De-ionized water inlet. An external multi-stage water treatment system will be supplied with this system. There are also some electrical connections for power and remote monitoring.

The ancillary equipment that will be included in this system will be: a DC/AC inverter designed to take the DC voltage from the fuel cell and change it to 120/240V AC output, absorbed glass mat lead acid Batteries in a 120V/26amp hour bank, fuel clean up module for sulfur removal, a water purification system that has been designed with knowledge of local water quality, a rugged outdoor enclosure to withstand the elements, a heater designed to keep the system from freezing, and a radiator system for heat dissipation.

The planned operating procedure for the system is to provide power for some security lighting that should amount to 1.5 to 2kW$_e$. This will serve as the systems base load. The fuel consumption at base load conditions should be approximately 6 slpm of propane (@25°C) and 40ml/min of water. The system is capable of producing a maximum output of 4.6kW$_e$, and will ramp up as necessary to match an increase in the load. The fuel consumption at maximum output is approximately 12 slpm of propane (@25°C) and 80ml/min of water. The system is designed for unmanned operation unless the system calls for outside intervention. The run data from the system will be retrieved by IdaTech.

Combustion exhaust and other gases are exhausted from the fuel cell system through an exhaust duct located at the back of the system enclosure. These gases must be vented to the outdoors through an exhaust ducting system. The exhaust ducting system includes a fan that must be installed in the exhaust duct.

9.0 Electrical System

For each of the systems the fuel cell will have a continuous output rating of 4.6 kW AC at 120/240 volts. The fuel cell systems will be operated at 2.0 kW AC electrical output and will be used to power security lighting and a UPS battery charger. All systems will be operated exclusively in Grid-Independent mode and will provide only AC output.

Each system will be interconnected to the host site using a sub-panel and automatic transfer switch (ATS). The sub panels will be used to break out circuit from the grid connected source, and instead power those circuits using the fuel cell system. An ATS will be installed that will be capable of transferring the sub-panel circuits back to grid power if the fuel cell system goes off-line for any reason.

10.0 Thermal Recovery System

No thermal recovery was proposed.

11.0 Data Acquisition System

Data is recorded as a text file in the system and is periodically downloaded by IdaTech through a high speed satellite modem connection. The major parameters being monitored by the system are various reactor and fuel cell temperatures and pressures that are pertinent to control and safety. The fuel and water flow rates are monitored as well as the power output of the system. If any one of these parameters, or others that are monitored by the system, displays an out of range value it will cause a system fault.

All faults cause the fuel cell system to shut down. Upon sensing a fault condition, the Fault indicator will illuminate, and the fuel cell system will automatically transition to the Shutdown state and then to Standby after the shut down process has completed. The shut down process requires approximately 5 minutes. During the shut down process, the Fault indicator will remain illuminated.

After reaching the Standby state, the Fault indicator will remain illuminated. All faults must be acknowledged and cleared by the user before the fuel cell system can be restarted. From the Standby state, the fuel cell system may be restarted, or disconnected from the electric power source by opening the all-pole switch or disconnecting the plug and socket.

Due to security issues, IdaTech was not be able to connect to a high speed data line at any of the sites. This will require the use of a high speed satellite modem and a periodic download of large data files to a laptop or CD that will need to be transferred from a location off-base.

12.0 Economic Analysis

Total energy savings is to be calculated using the formula:

Total energy savings = (electric energy and demand savings) + (thermal recovery savings) - (input fuel cost).

For this project demand charges are not considered and there is no heat recovery so energy savings would be a simplified calculation that subtracts the cost of the fuel from the value of the electricity.

The electric provider at Offutt AFB will be OPPD. The electric rate at Building 304 (natural gas system) will be 2.0 cents per kWh. Their will be a different electric rate of 5.4 cents per kWh at the Elkhorn Building 200 site (propane system). The natural gas for the project will be supplied by Northern Natural Gas at an approximate cost of 68 cents per therm, and the propane for the project will be supplied by Ferrell Gas at an approximate cost of $0.97 per gallon, or approximately $1.06 per therm.

Value of Electricity at Building 304 (natural gas system):

- 2.0 cents per kWh
- 2 kW continuous output
- Planning 7,884 hours of operation for demonstration.

0.020 * 2 * 7884 = **$315.36**

Value of Electricity at Elkhorn Building 200 (propane system):

- 5.4 cents per kWh
- 2 kW continuous output
- Planning 7,884 hours of operation for demonstration.

0.054 * 2 * 7884 = **$851.47**

Cost of Natural Gas:

- 13 liters per minute of natural gas to maintain 2 kW output.
- Planning 7,884 hours of operation for demonstration.
- 2,830 liters per therm
- 68 cents per therm

(7884 * 13 * 60) * (0.68/2830) = **$1,477.62**

Cost of Propane:

- 6 liters per minute of propane to maintain 2 kW output.
- Planning 7,884 hours of operation for demonstration.
- 1,131 liters per therm
- 1.06 dollars per therm

(7884 * 6 * 60) * (1.06/1131) = **$2,660.07**

13.0 Kickoff Meeting Information

See attached set of Kick-Off meeting notes and contacts.

14.0 Status/Timeline

The contract duration is 24 months from the date of the contract award. The following table shows the planned timeline for each of the three systems to be installed under this contract.

1	Apr-04	System Development
2	May-04	System Development
3	Jun-04	System Development
4	Jul-04	System Manufacture, Draft of Initial Project Description Report
5	Aug-04	System Manufacture
6	Sep-04	Complete Manufacture of System, Site Preparation
7	Oct-04	Test and Validation
8	Nov-04	Shipping, Installation, Training
9	Dec-04	Operation Month 1
10	Jan-05	Operation Month 2, Draft of Midpoint Project Status Report
11	Feb-05	Operation Month 3, Final Midpoint Project Status Report
12	Mar-05	Operation Month 4, Scheduled Maintenance
13	Apr-05	Operation Month 5
14	May-05	Operation Month 6
15	Jun-05	Operation Month 7, Scheduled Maintenance
16	Jul-05	Operation Month 8
17	Aug-05	Operation Month 9
18	Sep-05	Operation Month 10, Schedule Maintenance
19	Oct-05	Operation Month 11
20	Nov-05	Operation Month 12
21	Dec-05	Decommission, Removal, Remediation, Draft of Final Report
22	Jan-06	Completion of Final Report
23	Feb-06	CERL Review of Final Report
24	Mar-06	Contractual End of Project

Appendix

There are no Appendix materials to be attached at this time.